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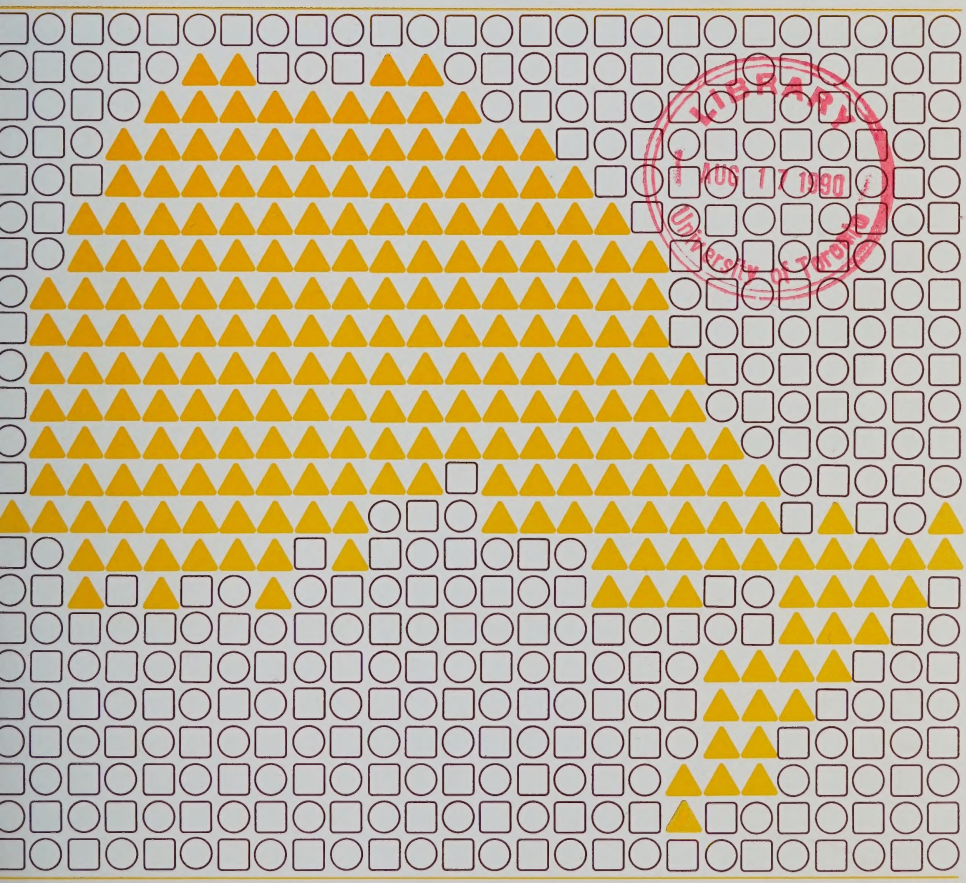
Volume 8, Number 2, Spring 1987

Workplace Hazardous Materials Information System

Right-to-Know 'The Legal Implications'

The Impact Assessment Study

Health Effects of Welding and Cutting Fumes and Gases



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Occupational Health in Ontario

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Workplace Hazardous Materials Information System*

Summary

This paper summarizes both the impact that the proposed Workplace Hazardous Materials Information System (WHMIS) regulations are likely to have on a supplier or importer of such products and the impact of the proposed standardized regulations in each jurisdiction across Canada.

Some time ago, the occupational safety and health regulators in Canada identified a problem that was relatively consistent across the country – employers were frequently having difficulty complying with occupational safety and health regulations that required them to provide their employees with information about the hazards of the materials to which they were exposed in the workplace. The problem appeared to be exacerbated by a lack of disclosure of those hazards by manufacturers from whom the employers purchased materials. Many occupational safety and health agencies had no jurisdiction to regulate conditions of sale, and the help of the federal government was sought to find a solution that would apply nationally – thus was the concept of WHMIS born.

In 1981 Consumer and Corporate Affairs Canada (CCA) was asked to organize and chair a task force to determine the feasibility of labelling hazardous industrial products as a condition of sale or importation under the federal *Hazardous Products Act* (HPA). The task force, comprised of officials from federal and provincial occupational safety and health agencies, Health and Welfare, and CCA, submitted a report in 1982 that proposed a triad of principal elements to convey information on hazardous materials in the workplace – a label, a Material Safety Data Sheet (MSDS) and a worker education program. Since industry and organized labour had not participated on the task force, Labour Canada was then asked to establish a tripartite consultation process so that the feasibility study could be expanded and would represent the interests of the affected parties.

That process resulted in the WHMIS Project Steering Committee report, tabled in the summer of 1985 before deputy ministers responsible for occupational safety and health. The report represented a unique and delicate consensus amongst governments, labour, chemical producers and user employers. It contained 87 recommendations concerning components of the WHMIS system, criteria for classifying hazardous materials, and implementation of

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the system on a pan-Canadian basis using a complementary legislative framework of federal legislation (an amended HPA) and standardized occupational safety and health regulations in each jurisdiction.

Although the report was accepted in principle by the deputy ministers, each jurisdiction needed time to review and react to its final recommendations. It was not until May 1986 that approval was given to establish a federal/provincial implementation co-ordinating committee (ICC), which was mandated to develop proposed drafting instructions and policy recommendations for consideration at the political level. The ICC met throughout the summer and converted the consensus recommendations of the WHMIS report into a legislative/policy package, which was presented to ministers collectively at a federal/provincial meeting in Hamilton at the end of September 1986. It should be noted here that, although industry and labour were not formally represented on the ICC, they did participate actively in the revisions of successive draft documents produced by the committee.

There is now ministerial agreement on the principle of WHMIS and on the intent to proceed to the cabinets in the respective jurisdictions for the policy and resource approval necessary to implement the proposed system on a national scale. A final review of more detailed estimates of public and private sector costs in each jurisdiction will take place shortly prior to amendments to legislation being tabled. It is anticipated that if governments give priority to the drafting of those amendments and the associated regulations, WHMIS could come into effect across Canada in mid 1988. That would provide suppliers and employers with approximately 18 months in which to prepare for compliance with the new requirements.

So, having explained the problem that prompted development of the proposed system and having outlined the process by which the system was evolved, I now direct our attention to the two scenarios that describe, albeit sketchily, what the system could mean for a producer of industrial chemical materials or for an employer whose workers use those materials. First, let us examine the responsibilities of a supplier under the proposed amendments to the *Federal Hazardous Products Act*.

Under the HPA, as a condition of sale or importation of any hazardous product to be used in a workplace, there would be a mandatory requirement to classify the hazard according to prescribed WHMIS criteria, to label the container, and to provide a Material Safety Data Sheet (MSDS) containing, amongst other things, a declaration of hazardous ingredients. However, given that WHMIS

is based on a delicate balance between, on the one hand, workers' legitimate 'right to know' and, on the other, industry's right to protect *bona fide* trade secrets, the HPA would also provide a mechanism by which suppliers could claim exemption from disclosure of certain categories of information. By regulating hazardous products at point of sale, the WHMIS provisions of the HPA would ensure a nationally consistent set of requirements for both interprovincially traded products and imports. It is important to emphasize at this point that any issues arising during the transportation of hazardous products from the supplier/importer to the purchaser (the employer) would be covered under Transportation of Dangerous Goods (TDG) regulations. WHMIS and TDG are, however, compatible.

The following example highlights the national application of WHMIS. Let us suppose a manufacturer in Montreal, Quebec, has been requested to supply a chemical to an oil servicing business in Calgary, Alberta. Before preparing the order for shipment, the supplier, under the proposed federal amendment, would have to comply with the WHMIS classification, labelling and MSDS requirements. The first thing he would have to do is determine whether the product meets any of the following hazard criteria:

1. Compressed gas
2. Flammable and combustible material
3. Oxidizing material
4. Poisonous and infectious material
5. Corrosive material
6. Dangerously reactive material

If the answer is yes, he will then have to conform to the other elements – labelling, and data sheets.

The label that he produces for his product must follow a specific format that is designed to provide sufficient information to meet hazard precaution needs under conditions of normal use. The following is an example of what he might affix to the product container.

Contents of Supplier Label:

1. Material identifier
2. Hazard symbols
3. Risk phrases (content not mandated)
4. Precautionary measures (content not mandated)
5. First aid measures (content not mandated)
6. Supplier identifier
7. Reference to the MSDS

Clearly, the intention is to identify information of great importance for the safe handling of the product and in case of possible emergency.

The next requirement is the MSDS. Under the HPA, the Montreal supplier will be allowed to sell his hazardous product only if an MSDS is supplied with his first shipment, and it must contain the following categories of information:

Contents of supplier MSDS:

1. Material identification and use
2. Hazardous ingredients
3. Physical data
4. Fire and explosion data
5. Reactivity data
6. Toxicological properties
7. Preventive measures
8. First aid measures
9. Person or group responsible for, and date of preparation of, MSDS

The supplier will have to provide information that is available in each category as it applies to his particular product. However, he is not required to conduct testing beyond any already completed. He is expected to use professional judgement in describing the existing data or information of which he is aware or ought reasonably to be aware.

If our colleague in Montreal is prepared to substantiate that disclosure of any of the ingredients in his product would result in economic loss or a competitive disadvantage, he will have recourse to a process that grants exemption from disclosing certain trade secret information that would otherwise be required on the label and/or MSDS. For his claim to be validated, however, he will have to demonstrate that the information meets the following criteria:

Trade Secret Criteria:

1. The extent to which the information for which the trade secret claim is made is known outside the supplier's business, excluding knowledge gained as a result of providing the information to governments and regulatory agencies.
2. The extent to which the information is known by employees and others involved in the supplier's business.
3. The extent of the measures taken by the supplier to guard the secrecy of the information.

4. The present or future value of the information to the supplier or the supplier's competitors.
5. The amount of effort or money expended by the supplier in developing the information.

If the supplier believes that he has a valid claim, he will be able to file that claim, for a fee, with a federal trade secret screening agency. Upon receipt of the claim, the agency will provide the supplier with a registry number, which permits the product to be sold with notification on the MSDS that a trade secret claim on the undisclosed information is pending, and the date of filing.

The following is the process by which trade secrets would be handled.

Trade Secret Claim Process:

1. The claim is first filed with the screener, and a registry number is issued.
2. The supplier would issue the MSDS without including the trade secret information, but with a notation that a claim is pending.
3. The screener would assess the claim against the criteria and review the MSDS.
4. The screener would decide on the adequacy of the MSDS – i.e. whether the information is commensurate with the nature of the product and what is known about the product.
5. The screener would decide on the validity of the claim and publish the decision in Part I of the *Canada Gazette*.
6. If the claim were denied, the product would be withdrawn or a full MSDS and label would have to be substituted.
7. If the claim were upheld, disclosure would not be required.
8. There would be provision for an appeal of the decision by affected parties.

WHMIS proposed a tripartite appeal mechanism whereby appeal boards would be convened on an as-needed basis, be chaired by someone nominated by the government in whose jurisdiction the appeal is heard and have two other members representing industry and labour. Since boards would be established under authority of the HPA, their decisions would be binding nationally. Review by the federal court would be permitted only on points of law.

So where does that leave our supplier in Montreal? Under WHMIS he will have only one set of regulations with which to comply as a supplier of workplace

hazardous material irrespective of where in Canada the purchaser of his product is located. Compliance with the requirements (other than the trade secret screening function) would be supported and enforced through his provincial occupational safety and health agency, which would have the appropriate powers under delegated authority of the federal HPA.

Out of necessity, the above scenario has been restricted to the minimum, but it has given a quick snapshot of the implications of the proposed federal WHMIS requirements for a supplier wishing to do business anywhere in Canada.

It is now worthwhile to look at what would happen under the set of complementary, standardized occupational safety and health regulations that would be administered by the 13 agencies in Canada. Users are located at the workplace, and thus will be regulated by the occupational health and safety agency having jurisdiction, whether provincial, territorial or federal. Therefore, it is necessary to identify the impact of the model occupational safety and health regulation on the user of a hazardous material. The employer at the purchasing workplace in Alberta can be used as an example.

A typical operator of a small business in the oil well servicing industry will find that many of the chemicals used are produced in Quebec. One of his problems is that many suppliers do not give much advice on how to use their products safely. The current labels are not standardized and there are no precautionary data on most of the materials. For a material to be used safely, information about both the hazardous properties of the material itself and the conditions under which it will be used must be available. While the user has information about the latter, the product information must obviously come from the supplier.

WHMIS is useful from the Alberta employer's perspective because he will get the information he needs from the supplier in Quebec.

But WHMIS also places responsibilities on users. An employer responsible for a worksite where a hazardous material is used has three major responsibilities:

1. Ensuring that containers of hazardous materials are labelled.
2. Ensuring that every hazardous material has a safety data sheet.
3. Training workers about WHMIS so that they will understand how to use the information on the labels and data sheets to work safely.

The provincial regulations will require the Alberta employer to check that the WHMIS label is on the containers when they arrive from the supplier in Montreal. If the drums are not labelled, he will have to get labels from the supplier before he can use the chemicals in his plant. The containers have to be kept labelled until they are completely empty. As larger containers, such as barrels, are often sent to a recycling plant, this provision will help the recycling plant, too. If any hazardous material is removed from the bulk containers for a small job, the smaller container has to be labelled, as well, with a worksite label. The worksite label can be a little simpler than the supplier label, but it must give enough information to identify the contents clearly and provide the necessary information for safe handling.

Small quantities of chemicals that come from lab supply houses and are intended for use only in a laboratory will need just the label that is already on them. Lab supply house labels meet the intent of WHMIS.

If the employer blends his own materials, he will have to make worksite labels for the benefit of his own workers. If he wants to sell any of the custom formulations, that will make him a supplier, and he will have to comply with the provisions of the *Hazardous Products Act* just like any other supplier.

Employers will have to ensure that suppliers send an MSDS for every product purchased. If an MSDS does not accompany the initial order, the employer will have to get one from the supplier before using the material.

The Alberta purchaser can revise the data sheets received from the Montreal supplier when workers need more detailed information because of some special use of a material. The only condition is that the modified data sheet cannot contain any less information than the one received from the supplier. All the data sheets will have to be kept readily available at the workplace so that workers can refer to them any time they need the information.

Modifying a safety data sheet is not an easy task; but at least the information on the raw materials will be available on the MSDS from suppliers. In addition, several consultant firms are getting into the business of producing data sheets. Most governments also have advisory programs. They won't produce the data sheet for the employer or supplier, but they can provide guidelines on how to do it and sources for the data that have to go on the data sheet. The Canadian Centre for Occupational Health and Safety also has a large chemical hazard information data base and has produced model data sheets on many materials.

As mentioned earlier, one of the biggest concerns in WHMIS has been confidentiality and the protection of trade secrets. For example, some oil well servicing companies have a problem because the big oil companies they work for do not want their competitors to know what is pumped down the wells. That could give away information on the productivity or geological formation of a particular oilfield. Usually, code names or unmarked containers are used.

Where a trade secret is involved, the employer himself can apply for a trade secret exemption on some of the details of the provincial labelling and MSDS requirements. The precautionary data still have to be there, but the trade secret ingredients can be identified by a code or a trade name. As WHMIS will have a single system for dealing with trade secrets, the user trade secrets will be reviewed by the same government agency that will deal with the supplier trade secrets. They will also review the MSDS for the trade secret product.

WHMIS will require a user or a supplier to give the trade secret ingredients to a physician when there is a medical emergency. For most materials, the ingredients will be right on the data sheets.

Another responsibility employers will have is to see that their workers are trained. Worker training is intended to be performance-oriented. Workers must be able to understand what WHMIS is all about and how to recognize the WHMIS label. They have to be trained to understand the meaning of the information on both the label and the MSDS so that they can take the precautions necessary to protect themselves. Joint worksite health and safety committees, where they exist, are supposed to participate in the training.

With respect to enforcement, the same occupational health and safety officer who regularly inspects a business will be the inspector for WHMIS. Should there be a problem with a supplier not living up to his obligations, the employer can advise the occupational safety and health inspector. The inspector will then get the inspector in the province where the supplier is located to deal with the problem. One important factor in the design of WHMIS has been to develop a 'one window' approach.

The model occupational safety and health regulation was developed as a draft for use by agencies with a responsibility for occupational health and safety. The model occupational safety and health regulation, if implemented as designed, will be complementary to the provisions implemented under the federal *Hazardous Products Act*. The combined result will be a pan-Canadian system where

workers will be provided with information on hazardous materials used in their workplaces.

Résumé

Cet article résume les répercussions qu'auront vraisemblablement les règlements envisagés dans le cadre du Système d'information sur les matières dangereuses utilisées au travail (SIMDT) sur les fournisseurs et les importateurs de ce genre de produits, de même que l'impact, dans chacune des administrations canadiennes, des règlements normalisés proposés.

Acknowledgement

The above paper was originally presented at the Gordon Group Conference on the 'Right to Know'. The text has been changed slightly to conform to a written format. The editor wishes to thank both the author and The Gordon Group for their permission to reprint the manuscript.

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Right to Know 'The Legal Implications'*

Summary

This paper outlines the legal requirements of proposed right-to-know legislation, the enforcement mechanisms conferred by the Occupational Health and Safety Act *and interpretations of court rulings.*

Introduction

Based on comments of the Ontario Minister of Labour, it is clear that legislation along the lines of either Bill 101, An Act to Amend Ontario's Health and Safety Act, or the federal Workplace Hazardous Materials Information System ('WHMIS') will be forthcoming in Ontario in the very near future.

Assuming, for the purposes of this discussion, that WHMIS or Bill 101 will be implemented in substantially the same form as Bill 101 exists today, a number of interesting legal questions arise for employers confronted with the implementation of a workplace safety scheme such as Bill 101 envisions.

As a framework for this discussion, it can be assumed that an employer governed by Bill 101 or similar legislation will be obliged:

1. to keep an inventory of all hazardous materials that are present, used, handled or stored in the workplace (section 22a(1));
2. to ensure that containers of hazardous materials are properly labelled (section 22c);
3. to make available material safety data sheets for hazardous material (section 22c);
4. to provide workers with instructions and training regarding these matters (section 22f).

While in an ideal world an employer would at all times be in compliance with the provisions of Bill 101, the fact that there is a need for such legislation in the first place indicates that this will not always be the case. Therefore, the question that arises is 'What are the consequences of a breach by an employer of the provisions of Bill 101?'

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Anticipated Enforcement Mechanisms Under Bill 101

Assuming that Bill 101 will be implemented as part of the *Occupational Health and Safety Act* (OHSA), the ordinary enforcement means under that Act will apply. There are four principal means of enforcing the OHSA that are available to the ministry. These are:

1. An order issued under section 29 where an inspector finds a contravention of the Act or regulations;
2. An order under section 20 where the director is of the opinion that agents used or intended to be used in the workplace are likely to endanger the health of a worker;
3. A complaint by a worker under section 24 to either the Ontario Labour Relations Board (OLRB) or an arbitrator appointed under a collective agreement, if any; and
4. A prosecution under section 37.

Before proceeding to a discussion of the enforcement mechanisms themselves, it is worth noting that the ministry has revised its policies in connection with issuing orders and concerning prosecutions. In brief, it is now the policy of the ministry that, where a contravention is found by an inspector, an order 'shall be issued except in the limited circumstances where an inspector is satisfied, on reasonable grounds, that due diligence has been exercised or the contravention is merely technical.' It is also the policy of the ministry that compliance with ministry orders must take place at the earliest practicable date.

(a) Inspector's Orders

An inspector has extensive remedial powers under section 29 if he finds a breach of the Act or regulations. If a 'danger or hazard to the health or safety of a worker' is created by a contravention, an inspector may issue a 'stop work order' under section 29(4) and may require, for example, that all work must cease, that machinery not be used or that the workplace be cleared of workers. The inspector may require that remedial action must be carried out immediately or within a set period of time. An inspector may establish a series of dates by which extensive corrective action must be completed, in which case, the employer must advise the ministry when it completes each stage of work required. In some cases, plans for remedying breaches of the OHSA must be reviewed with the ministry, which may require 'expert' reports concerning the suitability of proposed remedial measures.

In general, inspectors will discuss compliance dates with employers' and workers' representatives. Under the new policy on prosecutions, once a compliance date is agreed upon, failure to meet it will trigger consideration of prosecution under section 37(1)(b) of the Act. A prosecution will be launched unless the inspector is satisfied, on reasonable grounds, that the employer has made every reasonable effort to comply.

Section 28 of the OHSA provides inspectors, as part of their enforcement powers, with the right to enter any workplace, except one which is also a dwelling, without a warrant or notice, to require production of, and/or to remove, documents, to conduct tests, make inquiries of any person who is or was in a workplace, give orders that a workplace not be disturbed for a 'reasonable period' of time or require that professional reports be prepared at the expense of the employer.

Under section 32, an employer may appeal an order of an inspector to a director within 14 days of the making of the order. Appeals may be made in writing, orally or by telephone, and the director may require that the grounds of appeal be specified in writing. On the appeal, the director may substitute his findings for those of the inspector and may rescind or affirm the order appealed from or may issue a new order in place of the original order.

After a director has rendered his decision, there is no right of 'appeal' from it. However, an application for judicial review may be brought before the Divisional Court, which application would seek to 'quash' the director's decision on certain narrow grounds. Thus far, there have been very few such applications.

Before an appeal is actually heard, the ministry has adopted the practice of attempting to conciliate between the parties in order to avoid the necessity of an appeal hearing. In some cases, the appeal is abandoned as a result of conciliation or all-parties' consent to the amendment of an order. Where these attempts are unsuccessful, the appeals that do proceed appear to be becoming increasingly formal, with many employers and trade unions retaining counsel to represent them.

(b) Director's Orders

Under section 20, a director may issue orders to prohibit or control 'biological, chemical or physical agents' if, in the opinion of the director, the agent or its use 'is likely to endanger the health of a worker.' An order may permit the use of an agent subject to administrative controls,

work practices or engineering controls and may set time limits for compliance, which are specified by the director.

The director is not required to hold a hearing before issuing such an order, but his order can be appealed to the minister within 14 days of the making of the order. On appeal, a hearing is held, and the person hearing the case may rescind or affirm the order appealed from or make a new order in substitution therefor.

(c) Workers' Complaints

Under section 24, workers who are penalized for acting in compliance with the OHSA or the regulations thereto or for seeking their enforcement may file complaints with the OLRB or under their collective agreement. When hearing such a complaint, the OLRB has broad powers and, for example, can order the reinstatement of dismissed workers. In such a case, the employer bears a 'reverse onus' under section 24(5) and must prove that it did not deal with the worker contrary to the Act.

(d) Prosecution

The ministry is now laying many more charges under the OHSA. The current Minister of Labour has stated that his ministry will vigorously prosecute persons and companies violating the Act, and inspectors are acting on this policy. It now seems quite likely that charges will be laid after the second breach by an employer of the same section of the Act. As a result of this policy and the higher fines assessed of late, the issue of possible prosecution becomes a more important one for employers.

Every person who fails to comply with a provision of the OHSA or regulations or an order or requirement of an inspector, the director or the minister, is guilty of an offence and is liable to a maximum fine of $25,000 or to imprisonment for a term of not more than 12 months or to both. Under section 37(2), what is called a 'due diligence defence' is created in respect of alleged failures to comply with sections 13(1), 14(1)(b), (c), or (d) or 16(1) of the OHSA. As a result, even if the prosecution proves a breach of these sections of the Act or regulations, the defendant will not be convicted if he proves that he took 'every precaution reasonable in the circumstances.' This defence is discussed in greater detail below.

It should be made clear that, under section 37(3), employers are liable for the acts or neglect of any of their managers, agents, representatives, officers, directors or supervisors. However, an act of a 'worker' that is a breach

of the OHSA or regulations does not automatically trigger liability of the employer.

In addition, it has traditionally been understood that under section 37(3), a corporation could be convicted under the OHSA, based on the acts of the persons listed in section 37(3), even if the person who allegedly violated the Act, such as a supervisor, was acting in an unauthorized fashion. Therefore, until a recent court decision in *Cancoil*, discussed below, unless the offence was one to which the section 37(2) 'due diligence' exception was available, and unless the corporation could prove that it took 'every precaution reasonable in the circumstances,' the employer would be held liable for even unauthorized acts of its supervisors.

The penalty for most convictions is a fine against the company. However, individual supervisors, managers and workers are also personally liable under this legislation. In *R. v. Cotton Felts Ltd.* (1982), CESHG 95,056, which deals with sentencing under the OHSA, the Ontario Court of Appeal stated that the sentence imposed for breach of a public welfare statute like the OHSA would be determined based on the size of the company involved, the scope of the economic activity, the nature of the actual or potential harm to the public and the maximum penalty imposed by the statute. The Court held that fines should be 'substantial' and 'significant' without being 'harsh' in order to ensure that they will deter and will not be perceived as a licensing fee for breaches of the legislation. In that case, the company was fined $12,000 because of an accident in which a worker injured and lost his arm.

It would appear that the conviction of a manager or supervisor on a first offence will generally result in a fine of $500 to $1,500, which may be increased, depending on the particular facts of each case. In general, it appears that the ministry is now seeking substantial fines against employers, particularly in cases of repeated offences or serious injury.

Usually, the employer and the manager or supervisor responsible for the workplace will be charged when a prosecution is launched. Sometimes, the employee is also charged. As the OHSA does not require that there be consent to prosecute, there have been cases where an injured individual employee has prosecuted on his own initiative when neither the Ministry of Labour nor the Crown would initiate the proceedings.

The current Minister of Labour has indicated that he expects ministry safety inspectors to recommend prosecution of employers who fail to comply with orders issued under the Act. Prosecution will be considered whenever a

breach of the Act or regulations results in a fatality or critical injury. Finally, even if there has been no accident, an employer may be prosecuted if its conduct suggests a 'conscious or gross disregard' of its responsibilities under the OHSA and regulations. Since the Liberal government took office, there has been an increase in the number of prosecutions launched, and this increase is likely to continue in the future.

Anticipated Defences to Prosecution under Bill 101

(a) 'Due Diligence'

The defence of 'due diligence' arose primarily out of the decision of the Supreme Court of Canada in *R. v. Sault Ste. Marie* (1978), 88 DLR (3d) 161. In that case, the Court indicated that there are types of offences that require a degree of culpability falling between *mens rea* offences, in which the accused must have a guilty 'state of mind', and absolute liability offences, where conviction follows merely from doing the prohibited act. These 'in between' offences are ones of 'strict liability', and the courts have held that in the case of some violations of provincial statutes such as the OHSA, it is a defence if the accused can prove on the balance of probabilities that he was not guilty of fault or neglect. As noted above, the due diligence defence is expressly available under the OHSA to charges laid under one of the sections listed in section 37(2).

As an example, to establish a due diligence defence where an employee doesn't use the protective devices prescribed by the OHSA and regulations, it may be necessary to prove that the employee was trained in the use of protective devices, that safety rules were carefully monitored by the company and that disciplinary action was taken against employees who did not work in a safe manner as proof of the employer's efforts to compel compliance.

Although the due diligence defence provided for in section 37(2) of the OHSA is restricted to prosecutions under certain sections of the OHSA, the Ontario Court of Appeal held in *R. v. Cancoil Thermal Corp.* (1986) 14 OAC 225, that by operation of s. 7 of the *Charter of Rights and Freedoms*, the common law due diligence defence is available to any accused charged with a breach of any provision of the OHSA because conviction could result in imprisonment.

(b) The Defence of Officially Induced Error

The *Cancoil* case, referred to above, is also significant in that it suggests a possible defence based on 'officially induced error'.

In *Cancoil*, an employee operating a machine cut off part of his fingers while cleaning scrap metal from an unguarded blade. An inspector from the Ministry of Labour had inspected the factory approximately two months before the accident and was aware of the lack of a guard on the machine. The inspector noted that it was 'safe to remove the particular piece of metal in question and that with the machine being operated according to instructions, that it was safe to do so.' The inspector made no order then, but, the day after the accident, issued an order that the machine was not to be used until the guard was replaced.

As to a defence of 'officially induced error', the Court stated that:

> The defence of 'officially induced error' is available as a defence to an alleged violation of a regulatory statute where an accused has reasonably relied upon the erroneous legal opinion or advice of an official who is responsible for the administration or enforcement of the particular law. In order for the accused to successfully raise this defence, he must show that he relied on the erroneous legal opinion of the official and that his reliance was reasonable. The reasonableness will depend upon several factors, including the efforts he made to ascertain the proper law, the complexity or obscurity of the law, the position of the official who gave the advice and the clarity, definitiveness and reasonableness of the advice given.

In the *Cancoil* case, the Court held that the inspector was an official who administered the applicable law, was familiar with the OHSA and the regulations thereto and had the expertise to determine whether a machine had the necessary safety devices. However, as the defence of 'officially induced error' was not relied on at trial in the *Cancoil* case, it remains to be seen whether the defence of 'officially induced error' will be successfully used as a defence in future. In the interim, employers should keep records concerning the specific machines and work practices approved by inspectors who visit a workplace.

Conclusion

In concluding, it is apparent that the duties and responsibilities imposed under the proposed legislation are substantial and that it will take a tremendous effort by employers to meet the obligations imposed on them. Hopefully, the cost and difficulty of complying with the legislation will be more than outweighed by the benefits arising out of the existence of a safer workplace.

Résumé

Cet article expose les exigences juridiques liées à la législation envisagée sur le droit de savoir, les mécanismes d'application prévus par la Loi sur la santé et la sécurité au travail, ainsi que l'interprétation des jugements rendus par les tribunaux.

Acknowledgements

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The Impact Assessment Study*

Summary

Implementation of the proposed right-to-know laws will put tremendous pressure on companies. While the objectives of the legislation are highly desirable, the implementation period will be difficult, costly and, probably, fraught with confusion.

This article explores some of the components that make up a plan to assess the impact on plants and the methods to implement the provisions of the proposed legislation.

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Introduction

Implementation of the proposed 'right-to-know' laws will put enormous pressure on company management. Under Ontario's Bill 101 (an amendment to the *Occupational Health and Safety Act*, which addresses Right-to-Know), the ministry would effectively co-opt the entire labour force of Ontario as untrained inspectors. While the objectives of the legislation are highly desirable, the implementation period will be difficult, costly and, probably, fraught with confusion. The intent of this article is to explore some of the components that make up a plan to assess the impact on plants. It is confined to Ontario's Bill 101, with occasional qualifications related to WHMIS (Workplace Hazardous Materials Information System), as appropriate, as they both stand in mid-November 1986. The methodology to be discussed would apply to assessing the impact of any 'right-to-know' legislation in the workplace. Also explored are methods to implement the provisions of either the current version of Bill 101 or the Labour Canada WHMIS proposals.

As in the chemical or petroleum industries, where hazardous materials, their safe handling and worker protection have been part of the corporate culture for decades, most requirements of these laws are far from new. To other economic sectors such as general manufacturing or services, the impact on operations could be both profound and costly. The basic focus of this article is how to assess the impact of these 'right-to-know' laws and how to effectively use consultants when they are required. Basically, the following have to be addressed:

- What has to be done and by whom?
- How are those affected going to go about it?
- What will be the impact on a plant (which covers a range of things from procedural matters to costs and productivity)?
- How can consultants help in the planning and implementation phases?

* This paper was presented initially at the Gordon Group Conference on 'Right-to-Know', Toronto, November 6, 1986.

Consultants are considered to be any outside professional resource persons who are used to help bring a facility into compliance with the law. Basically, they provide temporary professional help of a specific nature. In large companies consultants could be from other divisions or corporate offices. Small companies will likely retain a professional for the specific assignment.

As a starting point, the requirements that Bill 101, as it stands after first reading, would actually impose on the workplace are:

A. The Inventory

The first requirement that is going to require action, time and cost is the inventory of hazardous materials. The inventory must be done; it must be updated at least annually, as changes will occur, and within 15 days of the introduction of a new material or total removal of a material. This is generally understood to be a quantitative accounting, not just a listing of materials present. Further, this information has to be condensed into a format suitable for distribution to a variety of parties, including the fire department and the Medical Officer of Health. (In some jurisdictions the general public is also included.)

B. Labelling and Material Safety Data Sheets

The next action item is related to hazardous material labelling and availability of Material Safety Data Sheets. The impact will vary, depending on whether a company is a producer, shipper or consumer of the hazardous materials. Of particular note is the requirement for labelling in-plant processing and storage containers. WHMIS also includes pipework and valves in the scope of the labelling requirement.

C. Trade Secrets

There are provisions for dealing with trade secrets that will be a major source of time expenditure for producers of proprietary products, and these are not discussed here. Hazardous physical agents have similar requirements for availability of safety information.

D. Training of Personnel

The last section that will have major short-term impact is the training provision. Everybody likely to be exposed to a hazardous material or hazardous physical agent must

have proper instruction in the information that is available, the Material Safety Data Sheets, etc., the purpose and significance of precautions, what these precautions might be and the risks associated with exposure to the material or physical agent. Further training in protective devices and equipment is also required.

The workers have to be checked annually on their level of training on these topics.

While this is a superficial summary, it is offered to highlight where consultants can help, both in setting up the programs and in maintaining them. There is a wide range of consultants available.

a) Management Consultants

Management consultants cover a wide range of skills. In this instance, there are specialists in information generation and handling procedures, training course specialists and management systems specialists. The overall objective is to ensure that information is available in a timely manner at the appropriate locations in the appropriate forms. This is not an easy task; it requires a lot of paperwork and solid information handling systems. Professional service on procedures for these tasks could save a considerable amount of wasted effort.

b) Occupational Health and Safety

Occupational health and safety experts focus on the critical area of assessing occupational exposures to the enormous range of hazards and potential hazards that can occur within the working environment. They are also the key professionals in setting up exposure assessment and monitoring programs. They are a very important input to any program because ill-conceived sampling programs can waste a lot of money. Attention must be paid to sampling methods, times and locations. Sample handling, analysis, interpretation and reporting is also critical as one misstep can sometimes invalidate a whole sampling program.

c) Hazard and Loss Control

Hazard and loss control consultants are specialists in risk assessment as it is applied to people and plants. This means risk of fire or explosion with indirect impact on people. Their experience gained with hazardous material handling and labelling can be invaluable in implementing a program as laid out under Bill 101 (under which a 'hazardous material' means a biological or chemical agent that is a hazard to the health or safety of a worker, etc. . . .). It is important to recognize that this is gener-

ally a separate and complementary function to that of the occupational health and safety input, which is focused more at the health impact on people.

d) Consulting Engineers
Consulting engineers enter the picture in two ways. Once an unacceptable exposure or potential exposure has been identified by the inventories and sampling program of whatever type, either:

i) engineers may be required to change procedures or the process to reduce the hazard, or
ii) equipment has to be changed, selected, designed or installed to reduce or eliminate the hazard.

I would, however, contend that well run corporations that have tried to comply with the intent of the existing *Occupational Health and Safety Act* (R.S.O. 1980, c.321) will not have to do much engineering control. The reason I say this is that specific provisions of the current Regulation 692/80 made under that Act are:

Section 131 'An industrial establishment shall be adequately ventilated . . . such that the atmosphere does not endanger the health and safety of workers.'

Section 134 'A worker who may be exposed to a biological chemical or physical agent which may endanger his safety or health shall be trained,
a) to use the precautions and procedures to be followed in the handling, use and storage of the agent;
b) in the proper use and care of required personal protective equipment; and
c) in the proper use of emergency measures and procedures.'

Section 145 'All measures necessary to prevent exposure to any toxic substance by inhalation, ingestion or skin contact shall be taken and . . . where any toxic substance is used or produced,
a) the substance shall be isolated;
b) adequate ventilation shall be provided;
c) personal protective clothing or equipment shall be worn or used;
d) quick-acting deluge showers shall be provided; or
e) eye-wash fountains shall be provided.'

The major engineering requirements and subsequent capital expenditures will occur in plants where no serious attempt has been made to comply with the spirit of the existing law. However, a major impact of Bill 101, even in plants with exemplary working conditions, will be caused by the flood of available information.

By way of an aside, of potentially much larger impact on capital plant requirements is the recent passage of the Regulation Respecting Control of Exposure to Biological or Chemical Agents (O.Reg.654/86), which provides exposure standards coupled with the requirement to provide engineering controls first, and respirators to be used only as a last resort. The capital expenditure consequences of this amendment will probably far outweigh those of Bill 101.

Figures 1 and 2 comprise a fairly typical Material Safety Data Sheet (MSDS) from a major chemical producer. It is important to assess the impact of these data on a worker with only a Grade 8 education. Much of the top part of Figure 1 is self-explanatory to a trained scientist or engineer, but to the non-technical person:

- what, for example, is vapour pressure? What is its significance?
- what is the lower explosive limit? Is 0.043 oz/ft^3 a lot or a little as an explosive limit?

In Figure 2 things get a little more difficult. After the fire, explosion and hazard data are found health hazard data. The first of these hazard indicators is a Threshold Limit Value (TLV), which is a common workplace expression to professional health and safety people. In Figure 2, for 'Lignosol' it says 'none allocated' – is it safe to breathe at all? A plant operator will have to explain to all the potentially exposed work force the significance of this, especially as there are only TLVs for about 600 chemicals out of tens of thousands in common trade.

Further down the sheet in Figure 2 there is LC_{50} or LD_{50}, the concentration or dosage of the chemical that is lethal to 50 per cent of test animals. For lignosol, it says the data are not available, which is another cause for uncertainty. Let us look at another chemical, soda ash, as an example. Soda ash is a relatively benign material in the scheme of things; it has an LD_{50} of 117 mg/kg (ip, mouse). From this it can be inferred that if you feed enough to a mouse you can kill it. How does that kind of knowledge help the plant work force?

Plant management is going to have to work hard to defuse the concerns and possible panic that a lack of understanding may cause. The educational step will be very

C-I-L Inc.

STANCHEM
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Material Safety Data Sheet

MATERIAL — Lignosol FG
UN N° — —
CAS N° — 8061-52-7
CIL N° — GCD-0220/83C

Emergency Tel. No

Halifax, N.S. (902) 469-9690
Montreal, Que. (514) 861-1211
Toronto, Ont. (416) 226-6117
Winnipeg, Man. (204) 943-8827
Edmonton, Alb. (403) 424-1754
Vancouver, B.C. (604) 685-5036

HAZARD RATING: NFPA

4 - EXTREME
3 - HIGH
2 - MODERATE
1 - SLIGHT
0 - INSIGNIFICANT
· - CHRONIC HEALTH HAZARD SEE SECTION 6

Section I. Identification of Product

TRADE NAME & SYNONYMS	CHEMICAL NAME & SYNONYMS
Lignosol FG	Calcium Lignosulphonate; Lignin Pitch Powder; Sulphite Lye
CHEMICAL AND PHYSICAL STATE	MOLECULAR FORMULA
Wood Chemicals — solid	Complex mixture — no exact formula known

SECTION II Physical Properties

APPEARANCE AND ODOUR

Yellowish coloured powder

BOILING POINT (°C)	MELTING POINT (°C) - FREEZING POINT (°C)
Not applicable	Not available
VAPOUR PRESSURE (MM HG)	SPECIFIC GRAVITY (WATER = 1 AT 4°C)
Not applicable	0.40 - 0.50
BULK DENSITY	VAPOUR DENSITY (AIR = 1)
—	Not applicable
SOLUBILITY IN WATER	OTHER SOLVENTS
Completely Soluble	—

Section III Fire and Explosion Hazard Data

FLASH POINT (°C) METHOD	AUTOIGNITION TEMPERATURE (°C)
Not available	485°C
FLAMMABLE LIMITS (% BY VOL. IN AIR) LOWER	UPPER
Glowing combustion temperature	510°C

WOULD ANY MATERIAL SATURATED WITH THIS PRODUCT MATERIALS BE SUBJECT TO SPONTANEOUS COMBUSTION? ☐ YES ☒ NO

FIRE EXTINGUISHING DATA

Use water, Carbon Dioxide or foam to extinguish fire

SPECIAL FIREFIGHTING PROCEDURES: Use water fog or spray to prevent formation of flammable dust clouds. Firefighters should wear a self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: May form explosive dust clouds in air. Lower explosive limit: 0.0433 oz./ft^3

Section IV Reactivity Data

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	XX	

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong oxidizing materials

HAZARDOUS DECOMPOSITION PRODUCTS: Sulphur Dioxide may be liberated in a fire or when the material comes into contact with strong oxidants

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	XX	

Figure 2 **Typical Material Safety Data Sheet, Page 2**

Section V	Health Hazard Data	
THRESHOLD LIMIT VALUE (TLV-TWA)	LC_{50}	LIGNOSOL FG ... P2
None allocated	Not available	
EFFECTS OF EXPOSURE WHEN: —INHALED	Nuisance dust. May cause irritation of the respiratory tract.	
—IN CONTACT WITH EYES	Slightly irritating dust which may cause redness	
—IN CONTACT WITH SKIN	Practically non-harmful; repeated or prolonged contact may cause irritation	
—INGESTED	Possible gastrointestinal distress	
EMERGENCY AND FIRST AID PROCEDURES —INHALATION	Remove victim to fresh air. If not breathing, give artificial respiration. Obtain medical attention immediately.	
—EYES	Flush eyes with running water for at least 20 minutes, holding eyelids open. If irritation persists, obtain medical advice immediately.	
—SKIN	Wash area thoroughly with soap & water. If irritation occurs, obtain medical advice.	
—INGESTION	Unless unconscious or convulsing, give large amounts of milk or water to induce vomiting. Obtain medical advice immediately.	

Section VI	Special Protection Information	
VENTILATION REQUIREMENTS	Local exhaust ventilation preferred	
RESPIRATORY PROTECTION	Air-purifying respirator if necessary	
PROTECTIVE GLOVES	Impermeable	EYE PROTECTION Safety glasses with side shields
OTHER PROTECTIVE EQUIPMENT	None usually required	

Section VII	Special Requirements
PRECAUTION IN HANDLING AND STORING	Store in a dry area to protect from caking
OTHER PRECAUTIONS	Keep area well ventilated to prevent formation of dust clouds

Section VIII	Spill or Leak Procedures
STEPS TO BE TAKEN IN EVENT OF SPILL OR RELEASE. IN ALL CASES NOTIFY APPLICABLE GOVERNMENT AUTHORITY IF SPILL IS SIGNIFICANT	Stop & contain leak or spill. Sweep or shovel material into bags for reuse or disposal. Flush area thoroughly with water.
ENVIRONMENTAL EFFECTS	Nuisance powder. May create an aesthetic nuisance to the environment due to colour & solubility of the material. Practically non-harmful to fish at low concentrations. Material may accumulate in the environment if spills are improperly contained.
NEUTRALIZING CHEMICALS	None required
WASTE DISPOSAL	Consult Federal, Provincial & Local regulations on chemical waste disposal. May be possible to flush small quantities down an industrial sewer. May be possible to burn in a furnace equipped with Sulphur Dioxide scrubbers.

Section IX	References
	1) REED LTD., Material Safety Data Sheet, 1981. 2) HAWLEY, G.G., The Condensed Chemical Dictionary, 1981.

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Chemicals
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85032 (REV 09/85)

demanding. If it is only a limited job and imparts only enough knowledge that there is no understanding of the level of hazard, the worker has the right under the existing act to refuse to work if he or she believes it may endanger his or her health or safety. This aspect is the hidden 'bite' of the present Bill 101.

As an aside, the excellent MSDS shown here, in Figures 1 and 2, with all its information still does not meet the requirements of WHMIS.

Returning to how consultants can assist in the implementation of Bill 101, let's start with the requirement for inventories of hazardous materials. What is included? As written, the provisions of Bill 101 will cover a ludicrous range of materials, including:

- cosmetics (expressly excluded by WHMIS)
- paints
- solvents
- janitorial supplies
- kitchen chemicals, etc.,

plus a multitude of other commonly used materials sold as consumer items and often used in the workplace. This range of items would be impractical to keep track of economically, and it is to be hoped that before Bill 101 is passed into law, a less all-encompassing formula can be worked out.

The Inventory

Focusing on the data processing and manipulation requirements, key inputs will be purchasing records, sales records and shipping documents or manifests. The documents give the basis for inventory building with a standard input-output inventory model.

On the input side, data are obtained from purchase orders, shipping and receiving documents. With very few exceptions these documents will give timely data on both anticipated and received materials and goods. Identifying the hazardous materials is where the labour starts. If the hazardous materials are provided with proper Material Safety Data Sheets, little skill is theoretically required in adding the material and its characteristics to the hazardous material inventory data base. From a practical point of view, procedures would be required to ensure that the Material Safety Data Sheet and the receiving report or shipping documents pass through a single set of hands, which often would not be the case. Further qualified technical input or review will likely be required to keep the input meaningful.

On the output side, the tracking is very difficult. Many hazardous materials will enter and leave the plant under the Federal Transportation of Dangerous Goods Regulations, clearly identifying many materials and quantities. But it will still usually be necessary to attribute material usage to units of production. In large sophisticated enterprises this is often done. In small jobbing shops it will be almost impossible to do economically. How it is to be done will clearly depend on the nature of the operation.

Two key areas where outside consultants can be of assistance are:

- setting up information systems
- inventory audits

Information Systems

The setting up of the information system to maintain the inventories will be a major task. Two critical stumbling blocks will be:

a) that many plants do not even have basic inventory control of any kind to start with; and
b) purchasing and sales are often under different line responsibilities and may be in different locations and could conceivably have separate and different computer systems.

These are typical of situations where information systems specialists can be of help.

The form of the input and output data can affect how the inventory is set up, and it is possible that purchasing procedures might require change. Similarly, in sales, the data for the inventory will have to be derived from a large range of possible sources. Proper formatting and timely delivery of information to data processing will be essential to a meaningful inventory control process. To close the material balances, input will also be required from waste management operations, with the manifests required under Regulation 309 of the Environmental Protection Act, and the environmental control departments. Even our most sophisticated manufacturers, such as the auto assembly plants, do not, currently, do this.

The Audit

With the required form of hazardous material inventory control, periodic inventory audits will be required. There is no real requirement for third party audits by consultants or others except that it will be an infrequent task, and assigning other internal resources could be difficult.

The Impact Assessment for the Inventory

The impact flows primarily from the costs of planning, setting the program up, training staff and changing or adding procedures. In operation there will be increased labour cost, probably in proportion to the number of purchase orders issued and received.

Depending upon a plant's actual operation it need not be a major task to quantify these costs.

Labelling and Identification of Hazards

If the plant is a manufacturer of hazardous materials, there could be considerable impact.

Figure 3 is a generic label proposed in the WHMIS documentation. Unfortunately, Ontario has not spelled out a format at the time of writing, although adoption of proposals compatible with WHMIS are anticipated.

- labels may have to be redesigned to comply with WHMIS;
- Material Safety Data Sheets may have to be prepared or changed and, in many cases, translated into other, minority, languages.

The Impact of Labelling

The impacts are again critically dependent upon the nature of the operation, but will typically include redesign of labels and possibly of packaging, both of which can be assigned start-up and ongoing costs.

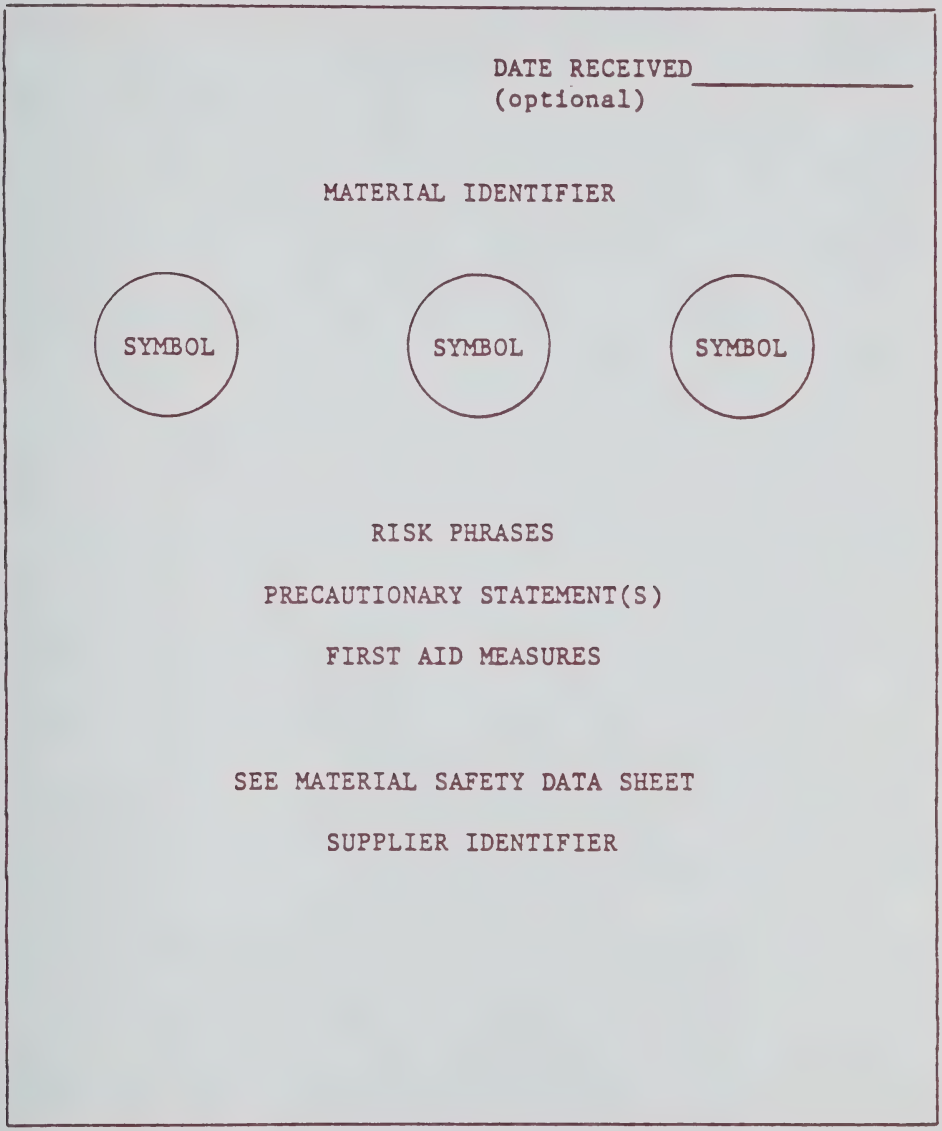
Preparing Material Safety Data Sheets

For the Material Safety Data Sheets, developing data may or may not be a major cost for manufacturers. If they are working with well-known materials for which a lot of information is available, the cost is low. If, however, they are operating in unknown territory, such as the bioengineering field, the costs could be extremely high. Typically, contract laboratories are the key players in information development with consultants able to offer guidance on what needs to be done and by whom, and to prepare data sheets.

Employee Training

The provision of employee training is clearly a major intent of the Ontario Bill 101. There is a very wide range of consultants specializing in preparation and presentation of training courses. There will be a real need to use strong technical groups with an understanding of occupational health, industrial hygiene, and safety and hazard

Figure 3 **Acceptable Formats for WHMIS Supplier Label**



control. Real expertise will be required in many cases to think properly through emergency procedures, which, potentially, can be the greatest concern.

The Training Impact

The impact of the personnel training requirement will probably be seen mostly in lost production time by the work force. Typically, the costs will be divided between 'external' costs for training-specialists with the required facilities and time off work by the work force to attend the sessions. Depending upon the nature of the operations, the cost will vary from almost trivial to very significant, with potential loss of productivity a competitive concern.

In plants with a wide range of hazards there will be a real benefit to limiting work force mobility or rearranging potential hazards to limit the number of specific procedures people have to learn.

When it comes to the technical impact of the various laws, the picture becomes more complex.

Identifying a Hazard

Again, it must be remembered that under section 23 of the existing Act in Ontario, 'a worker may refuse to work . . . where he has reason to believe that . . . the physical condition of the workplace . . . is likely to endanger himself.' If a plant has many identified hazardous materials, as many plants have, the potential burden of sampling to ensure that exposure standards and guidelines (as on the safety data sheets) are not exceeded is enormous. Clearly, both workers and management will sometimes need guidance on what is a hazard and what is not.

This is where the occupational health consultants and the hazard control consultants have a role to play. Occupational health consultants, with a knowledge base primarily related to health effects, can advise on the historical health problems associated with the industry. They can advise on normal good practice in the industry and identify the key concerns. For a given plant, they can do a walk-through audit to develop an understanding of the specific plant practices, the sampling program requirements and how to go about them. Most importantly, any sampling program needs careful planning, execution and interpretation to be useful or even valid.

Sampling is, in many ways, the backbone of most occupational health hazards evaluation programs. It can also be extremely costly, so proper planning of cost effective sampling programs is critical. It is also very important to recognize that data obtained by personal samplers, key ingredients in a hygiene sampling program,

are generally of very limited use in determining the source of contaminant, the relative importance of various possible sources or the absolute emission rates that often govern the size of abatement equipment. Two separate sampling programs are often required; the first to identify the source of the hazard, the second to quantify the effect of engineering controls.

The Material Safety Data Sheets will indicate a threshold limit value for a material. A perfectly valid question then becomes, 'Are these exceeded?' If there is no answer, sampling would have to be undertaken to demonstrate safety. In a small plant a modest estimate of the number of hazardous materials could be hundreds of separate items containing potentially thousands of hazardous ingredients. Sampling for several hundred chemicals is very costly, and, if it is to be done at a significant number of locations and repeated regularly, the cost becomes a major burden. When the hygienist is finished, there will generally be a range of recommendations left behind, covering how the work practices should be changed, what protective equipment is required, what engineering controls are required and what additional facilities may be required.

The hazard analyst wears a different type of hat. He or she is looking for potential loss situations where loss can be attributed to accidents or to loss of production. Bill 101 is striving to eliminate workplace hazards associated with materials or physical agents. The hazard analyst has done this for many years, typically being confined to the fields of chemicals, heavy industry and power plants where the consequences of accidents can be very severe.

The tools hazard analysts use are many. The most prominent is the HAZOP study, where every pipe, process reactor or unit is put through a rigorous 'what if' analysis to identify potentially dangerous conditions and eliminate or minimize them.

Failure Modes and Effects Analysis is a different system to achieve the same end, the identification of potential failures, what causes them and what are the consequences. Vulnerability models and fault/event tree analysis can be more statistically based, again trying to assess the likelihood of a hazardous situation occurring.

The analytical approach to evaluation of multiple event hazards is going to be required in many plants, particularly if, under WHMIS, the reactors with non-hazardous inputs and outputs but with hazardous intermediates have to be identified and labelled. Typical results of these studies might include identification of incompatible chemicals stored together. By incompatible is meant they could produce hazardous conditions if mixed accidentally.

Proper risk assessment also requires knowledge of the environmental fate of purchased materials. This is often complex, but future liability has to be understood.

But in general, these types of safety audits are directed to identification of primary and potential causes or sources of exposure to hazardous materials and agents.

The Engineering Consultant

After the hygienist and the hazard analyst have made their recommendations, various things will, likely, have to be changed. The analyst may want to eliminate some chemicals from your plant entirely. For materials with high associated risks, inventories might be reduced (at higher purchase cost) to minimize the storage hazards and potential liabilities. Should a plant have carcinogens, suspected carcinogens and substances designated by regulations around at all, if they can be avoided?

The processing route or the operating procedures may need changing. On the capital expenditure side, layouts of the plant or process could require changes, perhaps to isolate hazardous materials in a section of the plant or to limit the number of people potentially exposed. Equipment may have to be purchased. Typical of this would be hoods and ducts for dust and fume collector systems. Also, whenever dust or fume collection systems are installed, the Ministry of the Environment will have to issue a permit; therefore, proper liaison with the ministry is required.

There is not much need to dwell on the classical engineering consultant role of implementing process changes or abatement projects. Basically, a good engineer will require proper definition of the objectives, based on the hygiene and hazard analysis. The engineer will then quantify the sources of contaminant of concern. These cannot be guessed at when one is required to meet a legislated requirement. Options should be evaluated – the most cost-effective option selected – detailed designs made, drawings and specifications prepared for contracts and then reviewed by the Ministries of Labour and the Environment leading into procurement, construction and start-up.

Clearly, the impact assessment for this phase of compliance with Bill 101 is something that can only be determined when the most cost-effective solution has been developed. The impacts, in general, will be both capital costs and increased operating costs.

How to Select a Consultant to Help You

It is important not to leave the selection of a consultant to a purchasing agent. The corporation is purchasing an intellectual skill, specific experience and somebody the staff will have to work closely with. A procedure closer to hiring staff than to buying pencils is required.

The Consulting Engineers of Ontario strongly suggest the following approach:

- Locate companies with the required skills. There are a variety of directories to help you with this.
- Solicit short statements of interest based on geography and reputation in the field of interest. Include a request for references.
- Follow up with the references and make a short list. Call for proposals on a well defined work package.
- Interview the group or groups with the best technical proposals.
- When you are down to this stage, final discussion of fees becomes appropriate. Remember, however, that the consultant will probably have a good feel for the man-hours required for the scope as laid down. It's his or her normal business. Hourly rates may seem high, but maybe the most expensive consultant is the best in the business, and will save the plant a lot of capital or operating dollars through his or her knowledge. Again, retaining a consultant is not like buying pencils.

Summary of Impacts

Returning to the impact of implementing the 'right-to-know' laws, the direct impacts are fairly easy to define when they are broken down into the lists of small tasks discussed. In summary, Table I divides the impact into staff or consultant manhours to be spent, loss of productivity due to taking an employee from the workstation and capital costs. The inventory and labelling requirements don't affect the workers' productivity and only involve capital equipment if packaging changes are sufficiently major.

Training will have a marked impact on productivity. If one assumes a basic one-week training course for everybody, with a two-day annual update, it is a direct three per cent labour productivity loss across the board. There are probably not many medium or large plants where a week will give enough training to ensure understanding rather than create confusion and concern.

On the other hand, the indirect impacts can be far more significant, particularly on capital equipment requirements. Over the first few years of life under Bill 101,

management could be made extremely uncomfortable by the pressure of setting up the information and training programs with the subsequent pressure of uncertainty in the workplace.

It is going to be very trying for everybody.

Table 1 **Summary of Impacts**

	Manhours	Productivity	Capital
Direct			
Inventory	*		*
Labelling	*		*
Training	*	*	*
Indirect	**	*	***

Résumé

La mise en œuvre des lois envisagées sur le droit de savoir exercera des pressions considérables sur les entreprises. Bien que les objectifs poursuivis par ces lois soient fort souhaitables, la période de mise en œuvre sera marquée par des difficultés majeures, des coûts élevés et, sans doute, beaucoup de confusion.

L'article qui suit examine certains éléments d'un plan d'évaluation des répercussions que ces lois sont susceptibles d'avoir sur les usines et les méthodes de mise en œuvre des dispositions contenues dans la législation envisagée.

Acknowledgements

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Gary M. Liss, M.D., M.S., FRCPC

Health Effects of Welding and Cutting Fumes and Gases

Summary

The health effects, both acute and chronic, due to exposure to the products of welding and cutting processes are described. This article is a summary of the health effects document that is available from the Ministry Library.

Introduction

The numerous welding and cutting processes, together with the variety of base metals and consumables (e.g. welding rods), produce a complex number of exposure environments. It has been estimated[1] that the two major arc welding technologies, shielded metal arc welding (SMAW) with stick electrodes, and gas metal arc welding (GMAW) with continuous wire applied to mild steel, stainless steel or aluminum, account for 70 per cent of welding practice. The Hatch Report[2] suggested that these estimates are also applicable to the Ontario situation. The welding process produces potential respiratory hazards with a particulate fraction, which is largely respirable metal oxide fume, and gases, of which ozone and oxides of nitrogen are the most dangerous. The welding environment may also contain contaminants that are extraneous to the welding process, such as gases, e.g. phosgene formed from decomposition of chlorinated hydrocarbons remaining on metal surfaces after degreasing, and particulates such as those resulting from surface paint and coatings or from exposure to asbestos or silica, which may also be present near the welder.

Health Effects

Adverse health effects due to burns, radiation, electric shock and ergonomic problems are not considered in this review, but contribute to the burden of illness in welders. Some welding of metals may produce process-specific hazardous exposures: for example, during SMAW and, to a lesser extent, GMAW, of stainless steel, exposure to hexavalent chromium may occur; during GMAW with aluminum or stainless steel, excessive ozone exposure may occur. Also, high exposure to nitrogen dioxide may occur in confined spaces, and potentially toxic exposures can be associated with welding with specific welding rods (such as those containing beryllium or barium) or on specific coatings (such as cadmium). As a generalization, however, exposures to constituents do not generally exceed individual threshold limit values if total fume is kept at or below 5 mg/m^3.[3]

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Acute Effects

The health effects associated with welding fumes and gases may be acute or chronic. Acute effects are mainly restricted to the upper and lower respiratory tract system. Acute pneumonitis, bronchitis and pulmonary edema, including fatalities, have been reported following exposure to ozone, oxides of nitrogen, phosgene and cadmium fume. Such exposures may occur in confined spaces, or needlessly because of lack of awareness of the composition of consumables or coatings. At low concentrations, eye and throat irritation may be due to ozone, for example. Occupational asthma has been described in welders, but no estimate of prevalence or incidence can be made. Keskinen, *et al.*[4] reported five patients who developed asthmatic symptoms after SMA stainless steel (SMA/SS) welding and who demonstrated positive bronchial provocation tests on challenge with SMA/SS welding fume. Of three re-examined two years after cessation of exposure, one no longer reacted to welding provocation and two did. On re-challenge, these two patients developed reactions to SMA/SS fume but not to lactose, SMA/mild steel or GMA/SS fume. It was felt that the remarkably persistent asthmatic reactions in the absence of further exposure were caused by either chromium or nickel in the SMA/SS fume, but specific challenges with these metals were not performed.

Metal fume fever (MFF) is an acute febrile illness of short duration that results from inhalation of freshly formed metal oxides, most commonly, zinc. Many other metal oxides such as copper, magnesium, iron, manganese, nickel, selenium, tin and antimony have also been implicated. Up to 30 per cent of welders may be affected.[5] The symptoms, which may simulate a flu-like illness, occur four to eight hours after exposure, and include thirst, dry cough, metallic taste in the mouth, chills, dyspnea, malaise, muscle aches, headaches, nausea and, occasionally, vomiting. Fever and chills may be followed by sweating and, possibly, prostration, but these resolve by the next morning and the worker can return to work. Signs include a body temperature rise to between 38°C and 39°C (reaching a maximum 10 to 12 hours after inhalation), and polymorphonuclear leukocytosis.[6–8] MFF may occur on the first day a new employee works or particularly after a few days away from exposure (Monday fever). The illness resolves leaving no apparent chronic disorder. The cause is not known. Although MFF has manifestations resembling an immunologic disorder, no specific antigen has yet been identified. Also unan-

swered is why it can occur on the first day a person performs welding or why it develops only in some of the exposed individuals. Conceivably, the substances (perhaps histamine-like in nature) that lead to the manifestations of chills, fever and leukocytosis could be released by a direct toxic or pharmacologic interaction of a fume component with human cells. Although MFF occurs below the threshold of 15 mg/m^3 proposed by Drinker, *et al.*[9], data are insufficient to confirm the occurrence of attacks below 5 mg/m^3.

Chronic Effects

Because of the multitude of processes, confounding exposures (e.g. cigarette smoking) extraneous to the welding process itself, poor study design and lack of environmental data, the existence and magnitude of the incidence of chronic disease due to welding has not been easy to determine. The focus of attention has been on the respiratory tract. Patterns of absenteeism in welders have been examined and compared with those in boiler-makers, shipwrights, electric fitters, painters and joiners at naval dockyards[10] or compared with those in non-welders at a petrochemical plant.[11] Various indices, such as frequency of absence (annual inception rate of spells) and severity of absence (mean annual duration and length of spells), were analysed. There were no differences in absenteeism attributed to all diseases. However, welders appeared to exhibit more absenteeism attributed to respiratory (especially lower respiratory) tract disease compared with non-welders.

Those epidemiologic studies that have assessed chronic respiratory effects in welders have been cross-sectional in design and thus have suffered from the problems inherent in this study design. Most of these studies were concerned with mild-steel welders. There appeared to be a consistent increased prevalence, relative to the comparison groups, of chronic pulmonary symptoms (particularly sputum production and cough) in both smokers and non-smokers and in both shipyard[12–16] and non-shipyard[17–19] welders. However, there were insufficient data with which to relate these findings to duration of exposure, a specific constituent within welding fume or a particular level of a constituent. There is a suggestion, also determined from these and other[20] cross-sectional studies, of a reduction in pulmonary function in welders compared with controls, indicating an excess in welders of mild obstructive airways disease. The measures of pulmonary function affected included the forced expiratory volume in one

second (FEV_1), peak expiratory flow rate, mean mid-expiratory flow rate and forced expiratory flow rates at various percentages of forced vital capacity. Longitudinal prospective studies will be necessary to determine the incidence of such pulmonary function changes, identify whether the effects of welding are synergistic with cigarette smoking and clarify the rate of decline with time.

Siderosis, a pneumoconiosis due to pulmonary deposition of iron particles, appears as nodular radiopacities on chest X-ray. Siderosis without fibrosis is considered to be benign, and if fibrosis is present, the latter is considered to be due to exposure to other dusts, such as crystalline silica.[6] For example, Morgan and Kerr[21] described seven subjects with welders' siderosis, four of whom had lung biopsies. Fibrosis was not seen except in subjects with mixed dust exposures (mixed dust pneumoconiosis). Thus, the possibility was raised that mixed lesions/fibrosis that may complicate siderosis may be associated with silica or other components in welding fume or in the welding environment. The prevalence of siderosis has been shown by Attfield and Ross[22] to increase with duration of welding. These investigators estimated the prevalence of small, rounded opacities (0/1 or greater) to be 5.7 per cent after 20 years' exposure, 12.3 per cent after 30 years' and 18.2 per cent after 40 years'. However, no studies have been reported that would permit a correlation between exposure level to iron oxide and the development of X-ray changes. Despite the apparently benign nature of siderosis, there are a number of reports of symptomatic pulmonary disease with fibrosis and emphysema; these cases were confirmed by lung biopsy or autopsy.[23] However, as fibrosis in welders has been reported only in isolated case reports, it is not possible to conclude that there is an excess incidence in welders.

Traditionally, as indicated earlier, the search for health effects associated with exposure to welding fume and gases has focused on chronic respiratory diseases, while non-respiratory effects have been neglected.[24,25] Consequently, the reason for the apparent lack of non-respiratory effects may be due to a lack of appropriate investigations. Chronic neurologic disorders attributed to manganese exposure have been described in a few instances. Contact dermatitis with patch test results demonstrating a sensitivity to chromates has been reported in welders.[26,27] Of 250 persons with dermatitis and positive patch tests to potassium chromate identified in a Polish study[28], 132 had contact with chromates in an occupational setting, and 16 (12 per cent) of these had exposure to welding fumes.

It was not possible to determine if the initial sensitization to chromium occurred through non-occupational exposures, other occupational exposures or welding exposures.

Stainless-steel, but not mild-steel, welding fume appears to be mutagenic in *in vitro* tests in bacteria and in cultured mammalian cells. The mutagenic effect appeared to be associated with the water soluble fraction, and hexavalent chromium has been considered as one of the agents responsible for this activity. The two studies[29,30] examining chromosomal changes in lymphocytes of stainless-steel welders did not detect any differences in chromosomal aberrations between the welders and controls, but these studies did not exclude the possibility of point mutations.

The welding environment may contain a number of known or suspected metal carcinogens, two of which, nickel and chromium, appear in significant concentrations in stainless and some alloy steels. In addition, pyrolytic decomposition products from paints used on mild steel contain a mixture of organic materials of unknown carcinogenicity, and exposure of welders to other carcinogens, such as asbestos, may also occur in certain settings, such as shipyards.

Although some studies (mostly case-control studies) have suggested that welders have an increased risk of some non-respiratory cancers, further research is needed to confirm these findings.

There is a need, also, to assess further the possible risk of lung cancer in welders because of the presence in welding fume of metals of known or suspected carcinogenicity, the respirable nature of the fume and ease of route of entry by inhalation. The experimental studies assessing carcinogenicity of welding fume particles have, to date, been inconclusive.

Numerous mortality studies, based on death certificates and/or census returns, on shipyard welders and on non-shipyard welders consistently show a relative risk of lung cancer of the order of 1.3 or 1.4 compared with referent groups, usually national mortality rates.[1,24,31] Investigations in England and Wales[32] but not in Sweden[33] have suggested that welders may smoke somewhat more than the general male population. There are several possible explanations for this consistent association with lung cancer, which may or may not be causal. The first is that the risk from welding is negligible. The confounding effects of smoking in addition to exposure to other occupational carcinogens could account for the findings.

The second possible explanation for the association observed is that while mild-steel welding may involve little or no risk, certain welding processes, in particular stainless steel or chromate primed materials may constitute a 'hot spot'[1,34] with a higher risk of lung cancer. The reasoning is that as stainless-steel welding fume contains hexavalent chromium, stainless-steel welders will absorb chromium, that stainless-steel welding fumes contain mutagenic compounds, that chromium (VI) appears to be the (an) active contributor to this mutagenicity and that there are recognized increased relative risks of lung cancer in other industries where workers are exposed to chromates. The only published evidence of an increased lung cancer risk in stainless-steel welders is the study by Sjogren[33] in which a four-fold relative risk was reported, but this study was very small (based on only three cases) and needs to be confirmed.

The third possible explanation for the association of lung cancer with welders is that long-term employment as a welder of any type (even mild-steel) may cause an increase in lung cancer after a sufficient latency period has elapsed (for example, 20 years), as demonstrated in shipyard welders by Beaumont and Weiss.[35] This was the only study to include an informative analysis of findings by duration of exposure and latency. The relative risk 20 or more years after first exposure was 1.74 (39 observed, 22.38 expected; $p<0.001$). However, there was no relationship between risk and duration of exposure. A recent re-analysis of these data,[36] using a number of regression analyses, found that welding (versus non-welding) was associated with a non-significant elevated risk of about 30 per cent (rate ratio about 1.3). However, as yet, no candidate carcinogen has been identified in mild-steel fume, nor has mild-steel fume been shown to be mutagenic.

The published epidemiologic studies of lung cancer in welders generally suffer from methodologic limitations – small population size, confounding exposures, mixed processes, absence of quantification of exposure data and absence of analysis by duration of exposure or by latency. As Peto noted, 'We are therefore in the curious position of not knowing whether welding is among the most important current occupational carcinogens or whether its effects are negligible.'[31] To decide whether the association between lung cancer and welding is a causal one, large cohorts of welders, consisting of groups with long exposure to stainless steel and mild steel that can be followed for more than 20 years from their first exposure to welding, must be assembled.

Conclusion

From a review of the literature, it would appear that there is reason for concern that prolonged exposure to excessive concentrations of welding fume under past and, possibly, present conditions may present some degree of hazard to the health of welders. But the available data do not permit the health effects to be correlated with cumulative duration of exposure, much less with levels of specific constituents that can be deemed safe or not safe, as they relate specifically to the welding environment.

In Ontario[2] and elsewhere,[37] welders continue to be exposed to total fume and to specific constituents in excess of current standards in Ontario. Thus, it would appear that exposure to welding fume should be controlled, either by an exposure standard for total welding fume, as in the current *Regulation respecting the Control of Exposure to Biological or Chemical Agents* or by procedural means or by a combination of both.

Résumé

Cet article décrit les effets, aussi bien aigus que chroniques, que peut avoir sur la santé l'exposition aux produits des procédés de soudure et de coupage. On y résume le document qui a été préparé à ce sujet par le personnel du ministère. Il est possible de consulter ce document à la bibliothèque du ministère.

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Book Review

AIHA Recommendations for Asbestos Abatement Projects

Published by
The American Industrial Hygiene Association,
September 1986

Price available on request

This AIHA publication is a result of the work done by the Asbestos Task Force established by the American Industrial Hygiene Association. The Introduction states that the publication's primary purpose is to offer guidance to industrial hygienists and others involved in asbestos abatement projects on the selection of qualified professionals at each stage of the abatement process.

This reviewer feels that this statement is misleading since, from the very beginning, the publication appears to attempt to convince the reader that only industrial hygienists that are certified by the American Board of Industrial Hygienists (ABIH) in comprehensive practice are qualified to manage asbestos abatement projects.

One can understand why the AIHA finds it difficult to be more objective towards other professionals, but, as a result of this apparent bias, the publication loses both its credibility and practicality outside the United States.

To the knowledge of this reviewer, there is no other country that has, as yet, established a certification body similar to the ABIH. Who, then, should be in charge of asbestos abatement projects in other countries? Furthermore, there are few situations where being registered or certified is a legal requirement for industrial hygienists.

That being said, the publication is a quick reference to key points of asbestos abatement projects and recommendations for personal protection, respiratory protection, analytical methodology, toxicology, asbestos abatement project management, supervision, decision-making and risk assessment. This reviewer was especially impressed with the project monitor's checklist, which is thorough and exclusive of technical jargon. The recommended format for a final project report is also useful.

In the final analysis, the publication very methodically points out the deficiencies and gaps that may exist in asbestos abatement projects if a Certified Industrial Hygienist is not in charge.

G.S. Rajhans, CIH, P.Eng.

Publications Available From the Government Book Store

Revised Regulations of Ontario, 1980 Regulation 692/80 Industrial Establishments

Revised Regulations of Ontario, 1980 Regulation 691/80 Construction Projects

Inventory of Agents or Combinations of Agents for the Purpose of Section 21 of the Act. Ontario Regulation 693/80

Revised Regulations of Ontario, 1980 Regulation 694/80 Mines and Mining Plants

Regulation respecting Lead – made under the Occupational Health and Safety Act Ontario Regulation 536/81

Regulation respecting Mercury – made under the Occupational Health and Safety Act Ontario Regulation 141/82

Regulation respecting Vinyl Chloride – made under the Occupational Health and Safety Act Ontario Regulation 516/82

Regulation respecting Coke Oven Emissions – made under the Occupational Health and Safety Act Ontario Regulation 517/82

Regulation respecting Asbestos – made under the Occupational Health and Safety Act Ontario Regulation 570/82

Critical Injury Defined Ontario Regulation 714/82

Regulation respecting Fire Fighters Protective Equipment – made under the Occupational Health and Safety Act Ontario Regulation 125/83

Regulation respecting Isocyanates – made under the Occupational Health and Safety Act Ontario Regulation 455/83

Regulation respecting Silica – made under the Occupational Health and Safety Act Ontario Regulation 769/83

X-Ray Safety Code made under the Healing Arts Radiation Protection Act (R.S.O., 1980, Chapter 195 as amended S.O., 1984, Chapter 9) Ontario Regulation 45/84

Regulation to Amend Regulation 691 of Revised Regulations of Ontario, 1980 Ontario Regulation 156/84

Regulation to Amend Regulation 694 of Revised Regulations of Ontario, 1980 Ontario Regulation 190/84

Regulation respecting Teachers – made under the Occupational Health and Safety Act Ontario Regulation 191/84

Regulation respecting University Academics and Teaching Assistants – made under the Occupational Health and Safety Act Ontario Regulation 307/84

Regulation respecting Benzene – made under the Occupational Health and Safety Act Ontario Regulation 732/84

Regulation respecting Acrylonitrile – made under the Occupational Health and Safety Act Ontario Regulation 733/84

Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Occupational Health and Safety Act Ontario Regulation 654/85

Regulation respecting Arsenic – made under the Occupational Health and Safety Act Ontario Regulation 176/86

Regulation for X-Ray Safety – made under the Occupational Health and Safety Act Ontario Regulation 632/86

Regulation respecting Oil and Gas – Offshore – made under the Occupational Health and Safety Act Ontario Regulation 633/86

Regulation respecting Diving – made under the Occupational Health and Safety Act Ontario Regulation 634/86

Regulation respecting Control of Exposure to Biological or Chemical Agents – made under the Occupational Health and Safety Act Ontario Regulation 654/86

Support Literature

An Occupational Health Nurse's Guide to the Preparation of a Policy and Procedure Manual

A Guide to the Occupational Health and Safety Act

A Guide for Joint Health and Safety Committees and Representatives in the Workplace

Designated Substances in the Workplace: A General Guide to the Regulations

Designated Substances in the Workplace: A Guide to the Lead Regulation

Designated Substances in the Workplace: A Guide to the Benzene Regulation

Designated Substances in the Workplace: A Guide to the Silica Regulation

Designated Substances in the Workplace: A Guide to the Mercury Regulation

News and Notes

Regulations respecting Diving Operations

A Regulation respecting Diving Operations was filed with the Registrar of Regulations on October 30, 1986 under the provisions of the *Occupational Health and Safety Act* (R.S.O. 1980, c. 321). The regulation takes effect on January 29, 1987.

The new regulation specifies the procedures and equipment that must be used when workers are engaged in diving operations and places duties on employers, constructors, supervisors and workers. Diving operations are defined as work performed underwater for commercial, industrial, construction or environmental purposes and includes the underwater inspection, alteration, repair or maintenance of equipment, machinery, structures or ships and the salvage of sunken property of a commercial or industrial nature.

The Director of the Construction Health and Safety Branch must be notified of all diving operations before they are undertaken.

General inquiries with respect to the regulation may be directed to:

Diving Operations Project,
Ministry of Labour,
Standards and Programs Branch,
400 University Avenue,
9th Floor,
Toronto, Ontario,
Canada
M7A 1T7.

Telephone: (416) 965-8510

Ninth Semi-Annual Intensive Workshop in Industrial Hygiene

The Ninth Semi-Annual Intensive Workshop in Industrial Hygiene, to be held at the University of Toronto, is designed for professional occupational hygienists who, perhaps as a result of specialization, feel the need for a general refresher course, for recent entrants to the hygiene field who wish to broaden their background knowledge and for management, safety professionals

and labour representatives who wish to rapidly acquire an understanding of industrial hygiene.

The workshop is organized by the Department of Chemical Engineering and Applied Chemistry and will be held Monday, April 27 through Friday, May 1, 1987. The panel of lecturers includes Dr. John Steel, Dip.Occ.Hyg., of Newcastle-upon-Tyne, United Kingdom, personnel from the Ontario Ministry of Labour, and Faculty and Staff of the University of Toronto. The expertise of the speakers covers all relevant aspects of hygiene, risk assessment, human factors engineering, toxicology, occupational medicine and occupational health and safety legislation. A hands-on equipment demonstration is included in the workshop. The problem of coping with Ontario's designated substances will be specifically addressed.

The Industrial Hygiene and Hazard Control Engineering Program of the University of Toronto is presenting the workshop in association with the Occupational and Environmental Health Unit, Faculty of Medicine, University of Toronto and the Industrial Accident Prevention Association of Ontario. Professor J.W. Smith, Ph.D., C. Eng., C.I.H., Chairman of the Department of Chemical Engineering and Applied Chemistry, is Program Director.

Enquiries should be addressed to:

Mrs. Gloria Hetherington,
Department of Chemical Engineering
and Applied Chemistry,
University of Toronto,
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M5S 1A4.

Three Workshops at the University of Toronto, June 1987

A three-day workshop, 'Hearing Measurement and Conservation', will be held at the University of Toronto, June 8 to 10, 1987. Fee $325; a one-day 'Audiometry Refresher' workshop will be held June 11, 1987. Fee $125; and a three-day workshop on spirometry, 'Pulmonary Function Testing in Industry', will be held June 17 to 19, 1987. Fee $325.

For further information, contact:

School of Continuing Studies,
University of Toronto,
158 St. George Street,
Toronto, Ontario,
Canada
M5S 2V8.

Coming Events

May 4 – 6, 1987	First Conference on Education and Training in Occupational Health, International Commission on Occupational Health. McMaster University, HAMILTON, ONTARIO, CANADA. For further information, contact: Mrs. P.M. Yake, Occupational Health Program, McMaster University, Health Sciences Centre, Room 3H50, 1200 Main Street West, Hamilton, Ontario, Canada, L8N 3Z5. Tel.: (416) 525-9140, Extension 2332.
May 24 – 30, 1987	ILO's 11th World Congress on the Prevention of Occupational Accidents and Diseases 'Cooperation Towards a Better Working Environment: The Future of Safety and Health at Work'. STOCKHOLM, SWEDEN. For further information, contact: Swedish Organizing Committee, Post Box 22236, Stockholm, Sweden, S-104 22.
May 26 – 27, 1987	Health and Safety in Welding – Update '87. TORONTO, CANADA. For further information, contact: Art Ditschun, Welding Institute of Canada, 391 Burnhamthorpe Road East, Oakville, Ontario, Canada, L6J 6C9.
May 31 – June 5, 1987	American Industrial Hygiene Conference, MONTREAL, CANADA. For further information, contact: Kim Milush, AIHC, 475 Wolf Ledges Parkway, Akron, Ohio, U.S.A., 44311-1087.
June 9 – 11, 1987	4th International Meeting on Low Frequency Noise and Vibration to be held in UMEA. University of UMEA, HUMANISTHUSET, SWEDEN. For further information, contact: Dr. W. Tempest, Multi-Science Publishing Company Limited, 107 High Street, Brentwood, Essex U.K., CM14 4RX.

June 14 – 17, 1987	2nd International Congress on Back Pain – Current Concepts and Recent Advances. HONG KONG. For further information, contact: Congress Team International (U.K.) Ltd., Secretariat, 30 Deane Way, Ruislip, Middlesex, U.K., HA4 8SX.
June 14 – 17, 1987	Advancement of the Environmental Health Professionals, 51st Annual Educational Conference, SAN DIEGO, CALIFORNIA, U.S.A. For further information, contact: Mel Monkelis, National Environmental Health Association, 720S Colorado Blvd., Suite 970, South Tower, Denver, CO, U.S.A., 80222.
June 17 – 19, 1987	Fourth Annual International Hazardous Materials Association. 'Hazardous Materials – Emergency and Environmental Response'. SALT LAKE CITY, UTAH, U.S.A. For further information, contact: Katherine C. Blosch, Preferred Meeting Management Inc., 640 East Welmington Ave., Salt Lake City, Utah, U.S.A., 84106. Tel.: (801) 466-3500.
July 7 – 10, 1987	World Conference on Chemical Accidents, ROME, ITALY. Contact: Secretariat, CEP Consultants Ltd., 26 Albany St., Edinburgh, Scotland, U.K., EH1 3QH. Tel.: 031 557 2478.
August 8 – 13, 1987	International Congress of Epidemiology, HELSINKI, FINLAND. Contact: IEA-Congress Secretariat, POB 189, Helsinki, Finland, SF-00171. Tel.: 358-0-602163.
September 15 – 17, 1987	Inter-Noise 87, BEIJING, CHINA. Contact: Inter-Noise 87 Secretariat, 5 Zhongguancun Street, PO Box 2712, Beijing, China.
September 27 – October 2, 1987	XXII International Congress on Occupational Health. SYDNEY, AUSTRALIA. For further information, contact: The Secretariat, XXII International Congress on Occupational Health, G.P.O. Box 2609, Sydney, N.S.W., Australia, 2001.

October 10 – 12, 1987	Technical Seminar on Chemical Spills. TORONTO, CANADA. For further information, contact: M. Cloutier, Technology Development and Technical Services Branch, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8.
August 15 – 18, 1988	ICCEF 88. Third International Conference on the Combined Effects of Environmental Factors, FINLAND. Contact: Chairman, Doc DR Olavi Manninen, ICCEF 88, Secretariat, c/o Dept. of Public Health, Medical Faculty, University of Tampere, P.O. Box 607, Tampere, Finland, SF-33101.

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